⑲ 日本国特許庁 (JP)　　⑪ 特許出願公開

⑫ 公開特許公報 (A)　　昭58—111665

⑤Int. Cl.³	識別記号	庁内整理番号	⑬公開　昭和58年(1983)7月2日
A 23 L 1/325	101	6971—4B	

発明の数　1
審査請求　未請求

(全 5 頁)

⑤④繊維性フレーク様食品の製造方法

⑳特　　願　昭56—215414
㉒出　　願　昭56(1981)12月25日
⑦発 明 者　冠洋一
八王子市台町2—9—15
⑦発 明 者　山内孝文
八王子市寺町23
⑦発 明 者　高橋敏勝
八王子市元八王子1—240—9
⑦出 願 人　日本水産株式会社
東京都千代田区大手町2丁目6番2号
⑦代 理 人　弁理士　猪股清　外3名

明　細　書

1. 発明の名称　繊維性フレーク様食品の製造方法

2. 特許請求の範囲

魚介肉に食塩を添加し、混練して練肉とし、必要に応じてこれを脱気し、細孔を有するノズルを通してpH 3.5～5.5の食塩および酸からなる水溶液中に吐出して紡糸し得られた繊維状肉蛋白を集合して加熱した後切断し、水洗することを特徴とする、部分的に結着された繊維性フレーク様食品の製造方法。

3. 発明の詳細な説明

本発明は新規な繊維性フレーク様食品の製造方法に関するものである。

ここに「繊維性フレーク様食品」とは動物肉を再生、繊維化したものであって繊維状肉蛋白からなる集合結着されざる短い繊維性物質とこの繊維性物質を繊維の形態を残した状態で不規則に集合結着した小肉塊状物質が混在する食品又は後者だけからなる食品であり、かつ食感は筋肉繊維様の繊維感と歯応えを有し動物肉のいわゆるフレークと同等の食品を云うものとする。

近年食用蛋白を材料としてこれを繊維状に紡糸して食品として利用する試みがなされており、なかでも大豆蛋白等の植物性蛋白を材料とする場合にあっては原料供給の優位性とも相俟って、これを繊維化して食品とすることが既に実用化される段階までに至っている。

一方魚肉・畜肉等の動物性蛋白を材料とする場合にはいくつかの紡糸方法が提案されているにも拘らず、未だ産業的に利用されるまでに至っていない。この理由は製造工程が複雑であったり、製法が高度の技術を要したり、蛋白純度の高い原料が要求されたり、あるいは品質が安定し難いこと等が原因である。すなわち簡便で効率的な製造法がないことに起因している。

これらの実状から、発明者等は先に動物肉の加

塩擂肉を材料として、これを蛋白変性剤水溶液中に吐出紡糸して動物性繊維状食品を得る方法およびこの繊維が相互に集束結着された筋肉様繊維性食品を得る方法の二つの従来になく簡便で効率的な製造法を提供した。（特願昭55－82284、特願昭55－82285）。

このように本発明者等はバラバラの単繊維状の食品や筋肉塊状の繊維性食品を好適に得ることに成功したが、更に研究をすすめて、例えばカニフレーク肉、ホタテ貝柱フレーク肉、マグロフレーク肉の如くその一部は単一の繊維状をなし他の一部は筋肉繊維塊状をなすいわゆる繊維性フレーク様食品を得る方法を開発することを企図した。これらの食品は広く好んで賞味される商品価値の高いものでありこれを廉価な魚介肉から生産できれば附加価値を高めることができて有効である。

この繊維性フレーク様食品はさきに本発明者等の開発した方法により単繊維状の繊維性食品と繊維塊状食品を夫々別個に調製し適宜切断した上両者を混合することにより製造することはできるが、しかし夫々を別個に調製したり両者を混合したりすることは作業上不便であった。又得られる混合物は動物肉のいわゆるフレークとは形状が異なり不自然さが問題であった。

かくて本発明は一部は単一の繊維状をなし、他の一部は筋肉繊維塊状をなすいわゆる繊維性フレーク様食品を一挙に効率的に製造する方法を提供することを目的とするものであって、本発明者等によれば、魚介肉の加塩擂肉を食塩と酸の混合水溶液中に吐出紡糸し、これを部分的に集合、加熱し、切断することによって、その集合加熱時の繊維相互の附着力と切断時の外力とによって、前記の繊維性フレーク様食品が簡便に得られ、前記の目的を達成しうることが見出されたのである。

かくて、本発明は、魚介肉に食塩を添加し、混練して擂肉とし、必要に応じてこれを脱気し、細孔を有するノズルを通してpH 3.5～5.5の食塩および酸からなる水溶液中に吐出、紡糸し、得られた繊維状の肉蛋白を集合して加熱した後、切断し、水洗することを特徴とする部分的に結着された繊維性フレーク様食品の製造方法を提供するものである。尚本明細書において繊維又はそれに類似する語は通常前記水溶液中に吐出、凝固させてえられた繊維状の肉蛋白を意味するために、又紡糸なる語は前記のように吐出、凝固させて繊維状肉蛋白を形成する操作をいうものとする。

本発明について更に詳述すると各種魚介肉を原料として用いることができる。魚介肉としては、スケソウタラ、カレイ等の白身魚の肉、サバ、イワシ等の赤身魚の肉、エビ、オキアミ等甲殻類の肉、イカ、アサリ等の軟体動物の肉、更に鯨肉等各種の肉を利用することができる。これらは通常新鮮な又は冷凍後解凍されたすり身又はおとし身状の微細肉として用いられる。これらの魚介肉を適宜一種単独で又は2種以上混合して用いる。目標とする用途、食感等に応じて適宜材料を選択することができる。

このような魚介肉に食塩を添加し、混練して擂肉とする。食塩を添加し、混練することにより原料肉中の塩溶性蛋白が溶出して粘稠な肉糊となり、糸に引いても切れることなく連続的に紡糸することができる。食塩の添加量は原料肉の重量に対して1～10%、好ましくは2～6%の範囲である。混練はサイレントカッター、真空カッター、擂潰機等通常の水畜産練製品製造時に用いる装置によって行なうことができる。

食塩を添加し混練する際、必要に応じ種々の副原料や食品添加物を添加することができる。たとえばコーンスターチ、小麦澱粉、馬鈴薯澱粉等の澱粉類、調味料、香辛料、香料、色素、油脂、植物性蛋白あるいは卵白等であり、目的とする食感、特性等に応じて適宜選択して用いられる。

このように原料の魚介肉に食塩を加え、あるいは必要に応じさらに各種副原料を加えて混練して得られた擂肉を真空ミキサー等を用いて脱気する。又脱気は真空サイレントカッター等を用いて混練と同時に行なってもよく、擂肉を脱気することにより後工程の紡糸時に気泡の混入による糸の切れもなく、均質な物性の繊維を得ることができて好ましい。

次にこの練肉を細孔を有するノズルを通じて必要に応じて加圧しつつ凝固浴中へ吐出する。このノズルとしては内径1.5㎜以下好ましくは0.1～1.0㎜の細孔を有する金属製等のノズルが用いられる。細孔は真円形でもあるいは扁平な楕円形の形状であっても良い。また細孔を一つだけ有するノズルを用いることはできるが通常は多数の細孔を有するノズルが用いられる。その際複数の形状および複数の内径の細孔を有する複合ノズルを用いることもできる。

練肉はこのノズルから凝固浴たる食塩および酸から構成される混合水溶液中に吐出される。この混合水溶液の食塩の濃度は15重量%以上が好ましい。酸としては塩酸、燐酸等の無機酸、酢酸、クエン酸、フマール酸、乳酸、リンゴ酸、コハク酸等の有機酸を用いることができる。この場合この水溶液のpHを3.5～5.5好ましくは4.0～5.0の範囲に保つ程度の量の酸が用いられる。この食塩と酸の水溶液には、また水酸化ナトリウム、酢酸ナトリウム、クエン酸ナトリウム等の緩衝剤としての塩類を加えることが好ましく、pHが安定するので均質な繊維が得られる。尚この凝固浴として食塩と酸をそれぞれ単独に用いても効果が少なく、両者を併用することにより相乗効果が得られ短時間のうちに凝固繊維が得られるのである。上記の濃度範囲あるいはpH範囲をはずれると紡糸凝固が不完全でカマボコとなってしまったり、あるいは逆に凝固が過度となって後工程で集束結着ができず食感も硬すぎて脆くなったりし不適当である。

この食塩と酸の混合水溶液は通常常温で用いられ、必要に応じて加温してもよい。ノズルから吐出された練肉はこの水溶液中で通常数秒～3分間で表面の蛋白質が凝固硬化されて紡糸成型されるが、未だ完全に結着力を失わずに若干の附着力を残した状態に保たれる。より硬くしたい時はこの水溶液中での浸漬時間を心持ち長目にしてもよい。紡糸口の大きさや吐出圧、酸性水溶液の種類、濃度、pH、浸漬時間等紡糸時の各種条件を適宜調節することによって凝固変性度合、あるいは生成繊維の強度を調節し、後の集合結着工程の効率化をはかることができる。

このように食塩と酸の水溶液中に吐出され、紡糸成型されて得られた一本又は複数本の単繊維は必要に応じて水洗後集合して加熱し繊維状態を保ったままその一部を集束結着させる。複数本の単繊維の中の適宜本数の単繊維を集束結着させたり、同じ単繊維の中適宜箇所、適宜長さを他の単繊維と集束結着させたり、これらを組合わせたり、一部集束結着させる態様は任意である。一部を集束結着させる具体的な手段としても種々あり、例えば一本乃至複数本の単繊維を直線状で、或はリング状に巻いたり、絡み合わせたり任意の状態でカゴ、ザル、モッコ、リテーナー等の容器に入れたり、蒸器中に適宜本数を積層してほぼ平行に並べたり、あるいは連続的にコンベアー上に集積したり、ロールの間に挟んだりしながら、或はバッチ式に、或は連続式にボイル、蒸煮、高周波加熱等の任意の加熱手段で集合加熱させる。

このように加熱すると蛋白が熱凝固すると同時に、繊維の保有する附着力によって、接近し合った部分積層された部分、交叉した部分などの一部の繊維同志が繊維形状を保ったままで、何らバインダーを用いることもなく容易に結着する。このように集合して加熱する際に集束された繊維に適宜圧力を加えることにより結束の程度、即ち繊維状部分と繊維塊状部分との比率割合を調整することもでき、強く加圧したり、広く加圧したりすれば結着部即ち繊維塊状部分が多く、繊維状部分の少ないフレーク状態となる。例えば加熱前後に繊維集合体に適宜部分的に又は全体的に網を乗せるかローラーにかけるなどして圧力を加えたり、連続的にローラー加圧したり或は生繊維を多段に積層することにより自重をかけておいたりして結着程度を加減することができる。尚集束結着は一方向のみでなく多方向にも行なうことができる。

このように紡糸され集合加熱されて一部集束結着した繊維は次いでカッター、チョッパー、スライサー等を用いて適当な長さに切断される。この切断時の外力によっても、また結着が進行したり、

あるいは脱離してばらけたりして一層フレーク状の形態が整う。切断する長さは0.5～3㎝位が好ましく、又加熱直後の熱いうちに切断するほうがより結着し易く好ましい。

切断後次いで水洗される。水洗により過剰の食塩や酸が取除かれ洗滌されると共に水冷の効果も期待できる。更に調味、賦香、着色等が必要の場合にあっては調味液によるボイルや調味料香料混和あるいは染色等を行なうことができる。染色は集合加熱時に行なってもよく、例えば加熱前あるいは後に着色料を塗布したり、ボイル時外染を同時に行なったりすると便利である。

このようにして得られるフレーク様繊維性食品は従来の植物蛋白繊維やアルカリドープ法の繊維等に比べ不快な植物性蛋白臭や酸アルカリ味もなく、カニ足蒲鉾のような魚臭や甘味もなく風味良好で色沢優れ、物性食感面においても蒲鉾等の水産練製品の食感とは全く異なり、しなやかで伸びのある筋肉繊維と全く同じ強い繊維感と歯応えを有し、更にその形態は一部単独繊維一部繊維束から成り、カニ肉や貝柱肉等の筋肉をほぐしたいわゆるフレーク肉と同じ形態と外観を呈することが特徴で他に類をみない優れたものである。

このような本発明は次のような利点を有する。まず紡糸するに当っては魚介肉に食塩を添加混練して得られる練肉をノズルから食塩と酸の混合水溶液中に押出すのみで紡糸しうるのできわめて簡単で効率的である。このように原料として魚介肉を細切するだけで利用できるので高度の蛋白純度を要求されることもなく有利であり、また練肉中に各種の副原料が混在しても差支えないので、いかようにも繊維の品質を調整することができ、又品質の安定化を計ることもできる。そして細くしかも繊維強度の強いしなやかな繊維が得られるので、切れることもなく連続的に紡糸でき能率的である。更に本発明によれば紡糸時に繊維が結着力を残したまま凝固成型されて、後の集合加熱工程でその一部が集束結着され何らバインダーを用いることもなく繊維塊と単独繊維の混合物いわゆるフレーク肉が一挙に得られる。したがって、繊維と繊維塊を別個に作ってこれを混合する煩雑さもなく簡便であり、又カゼイン等の結着剤を用いた場合のように結着部分の異味異臭や食感の異和感等が全くなく筋肉に酷似したフレーク肉が得られ附加価値の高いものである。そして本発明では原料配合、凝固浴たる食塩と酸の水溶液の種類、濃度、pH、温度、流速あるいは紡糸時の口径、吐出圧更には集合加熱時の集合法、加熱法、圧力もしくは切断法等の各種の条件を適宜調整することによって生成繊維の強度、伸展性、食感あるいは結着度合を自由にコントロールしきわめて多様の食感、形状の製品を得ることができてまことに応用範囲の広い有効な製造法である。

かくて本発明による時は魚介肉を材料として、細く紡糸成型してこれを部分的に集束結着させることにより、品質面において高級で優れたフレーク様繊維性食品を簡便にきわめて効率よく得ることができるものであり、本発明はこの種繊維性食品の製造法として誠に有効なものを提供しうるのである。

以下本発明の実施例を挙げる。

実施例1

冷凍スケソウタラすり身10㎏を解凍し、これに食塩400gおよび焼酎醸粉2㎏を添加し、真空サイレントカッターで混練、脱気して練肉とした。この練肉を内径0.7㎜の紡糸口30個と0.7×1.3㎜の楕円紡糸口2個とを有する紡糸ノズルを通して、食塩15%、酢酸1.5%、苛性ソーダ0.6%、pH4.7の混合水溶液中に油圧によって吐出し、2分間浸漬後これをネットコンベアー上に厚さ20㎜となるように集積し、蒸煮ボックス中で10分間蒸煮した。次いでこの繊維集合体の表面の一部に赤色色素を塗布して、直ちに内径18㎜の開口プレートを有するチョッパーで切断した後15分間水洗した。これをミキサーに移し調味料250g、香料40gを混和してカニフレーク様繊維性食品13㎏を得た。

得られたカニフレーク様食品を市販のカニ風きざみ蒲鉾と共にパネル30人を用いて二点嗜好試験を実施した結果は第1表のとおりで、本発明によ

るカニフレーク様繊維性食品のほうが1%危険率でも有意に好まれた。

第1表

	形態	色	食感	風味
本発明例を好む人数	23	26	28	24
市販品を好む人数	5	4	2	6

実施例2

イカの足部をアルカリ剥皮して得たイカゲソ肉3Kgとスケソウタラおとし身2Kgに食塩200g、コーンスターチ300g、小麦グルテン150g、大豆油700gを添加してサイレントカッターで混練し、次いでミキサー中で脱気して練肉5.5Kgを得た。

この練肉を0.5mmの紡糸口を通してギヤーポンプを用いて、pH4.6の食塩飽和クエン酸緩衝液中に吐出し、1分間浸漬して紡糸した。これを金網のボイルかごに入れ、上から2Kgの重石を乗せて加圧しつつ7分間ボイルし、直ちにサイレントカッターで約13mmの長さに切断したうえ水洗して

に切断し、更に調味液で3分間ボイルしてエビフレーク様繊維性食品1.1Kgを得た。

得られたエビフレーク様食品300gをスケソウタラすり身150gで結いで太さ15mm、長さ8cmの棒状に成形し、これにパン粉付けを行ない－30℃で凍結し、175℃で3分間油揚して食したところ通常のエビフライと全く同等の風味と食感を有するものであった。

ホタテ貝柱フレーク様繊維性食品5.3Kgを得た。

得られたホタテフレーク様繊維性食品を空缶に充填し注液後脱気巻締して114℃で40分間殺菌して缶詰とし、これと市販のホタテフレーク缶詰とを二点比較による官能検査を実施した結果は第2表のとおりで、両者に有意差は認められなかった。

第2表

	良いとする人数 (n=24)
本発明例	11
市販缶詰	13

実施例3

南極オキアミ生剥身肉1Kgに食塩30g、澱粉100g、卵白30g、大豆蛋白30g、小麦蛋白30g、着色料0.1gを添加して擂潰機で混練し、バキュームミキサーで脱気して練肉とした。この練肉を内径0.3mmの紡糸口を通して食塩20%を含むpH3.0の塩酸水溶液中に吐出紡糸し1分間浸漬後、これを塩化ビニリデンフイルムで包んで蒸器で10分間蒸し、3分間水洗後約8mmの大きさのみじん

出願人代理人　猪股　欽　　清

(11) Patent publication No. 58-111665

(43) Publication Date: July 2, 1983

(54) METHOD FOR MANUFACTURING FIBER-LIKE FLAKE-TEXTURED FOOD

(21) Application No. 56-215414

(22) Application Date: December 25, 1981

(71)Applicant : NIPPON SUISAN KAISH LTD.

SPECIFICATION

1. Title of the Invention: METHOD FOR MANUFACTURING FIBROUS FLAKE-LIKE FOOD

2. Claim

A method for manufacturing fibrous flake-like food in which fibers are partially bonded to each other comprising the steps of adding salt to meat prepared from fish or shellfish, grinding the meat into a paste, de-aerating the paste as needed, extruding the paste through nozzles having a small aperture into fibers which are then immersed into an aqueous solution of salt and acid with a pH adjusted to pH 3.3-5.5, gathering fibrous meat proteins, heating the gathered mass and cutting it into pieces, and rinsing the pieces with water.

3. Detailed Description of the Invention

The present invention relates to a method for manufacturing novel, fibrous flake-like food.

The "fibrous flake-like food" used herein refers to a food product obtained by reconstituting animal meat to give it a fibrous texture in which short, separate fibers consisting of fibrous meat proteins, and meat globules retaining a fibrous texture consisting of disorderly arranged short fibers gathered and partially bound to each other are intermingled, or in which only meat globules as described above exist. The food has a texture similar to that of muscle fibers, and exhibits a resistance to bite when bitten, and closely resembles the so-called flakes of animal meat.

Recently, methods have been developed for molding edible proteins into fibers and processing the fibers into fiber-textured food products. Among such methods, those using, as a material, plant proteins such as soybean protein have almost reached the stage of industrialization, partly because supply of materials is sufficient.

For fish and livestock meat-derived proteins, some methods have been proposed for molding the proteins into fibers as well. None of them, however, have been put into practice. This is ascribed to the following reasons: the production process is very complex, requires high technology, or requires a material having a high protein content, or, even if products are obtained, they tend to vary in their quality. Briefly, the main reason lies in the absence of a simple and efficient method for processing animal meat into fibers.

In response to this situation, the present inventors had provided two simple and efficient methods for processing animal meat (Japanese Unexamined Patent Application Publications Nos. 55-82284 and 55-82285): one for obtaining animal meat-based fiber-textured food comprising extruding animal meat paste through nozzles into fibers which are then immersed into

an aqueous solution of a protein denaturing agent, and the other for obtaining muscle-like fiber-textured food in which fibers are gathered and bound to each other.

Thus, the present inventors had succeeded in providing methods suitable for obtaining two kinds of food products having a fibrous texture, one of which consists of unbound fibers gathered together, and the other of which consists of fibers bound together into a muscle-like mass. As an extension of this study, they tried to find a method for obtaining fibrous flake-like food in which, like flaked crab meat, scallop's adductor muscle or tuna meat available on the market, unbound fibers and meat globules consisting of bound fibers are intermingled. The cited flaked animal meat-based products have been eagerly accepted by consumers, and have a high marketing value. If it were possible to provide a method for preparing such flaked meat-based products from fish or shellfish meat, it would be advantageous because the method could confer an extra marketing value to comparatively cheap fish or shellfish meat.

In fact, it was possible to obtain such fibrous flake-like food by combining known methods, i.e., by separately preparing a fibrous meat mass consisting of unbound fibers and a fiber-textured meat mass consisting of bound fibers by the two methods developed by the present inventors, cutting the two meat masses at desired intervals, and combining the cut meat pieces together. However, this method required separate preparation of two different meat masses, and later combining of the two meat masses which complicated the process. Moreover, the resulting mixture was so different in shape from the so-called flaked animal meat that it had an unnatural

appearance.

The present inventors aimed to provide a method to efficiently produce, in a single continuous process, a so-called fibrous flake-like meat product which consists partly of unbound meat fibers and partly of fiber-textured globules comprising bound meat fibers. They found that it is possible to achieve the above object by taking a salted meat paste prepared from fish or shellfish, extruding the paste through nozzles into fibers which are then immersed into an aqueous solution of salt and acid, gathering the fibers so as to make them partially bind to each other, and heating and cutting the resulting fiber mass, because in the fiber mass, fibers become bound to each other as a result of heating and pressure exerted during cutting, to readily turn into a fibrous flake-like meat mass.

Thus, the present invention provides a method for manufacturing a fibrous flake-like meat-based food in which fibers are partially bonded to each other comprising the steps of adding salt to meat prepared from fish or shellfish, grinding the meat into a paste, de-aerating the paste as needed, extruding the paste through nozzles having a small aperture into fibers which are then immersed into an aqueous solution of salt and acid with a pH adjusted to pH 3.3-5.5, gathering fibrous meat proteins, heating the gathered mass and cutting it into fibrous flakes, and rinsing the flakes with water. The term "fiber" or its related terms used herein refers to meat proteins in the form of fibers which are obtained by extruding a meat paste through nozzles into fibers which are then immersed into the aforementioned solution so as to become hardened. The term "fiber molding" used herein refers to the aforementioned process in which a meat paste is extruded through nozzles

into fibers which are then immersed into the above solution so as to become hardened.

To describe the present invention more specifically, the materials to be used include meat from various kinds of fish and shellfish. Suitable materials include, as the meat of fish and shellfish, white meat from pollock, flatfish, etc., red meat from mackerel, sardines, etc., meat of crustacea such as shrimps, krill, etc., meat of mollusks such as squid, clams, etc., and meat of whales. Usually, the meat from fish or shellfish may take the form of minced meat such as a paste or fillets prepared from fish or shellfish freshly caught or frozen. The meat may be prepared from one kind of fish or shellfish alone or two or more kinds of fish or shellfish in combination. The meat material may be chosen as appropriate depending on the desired application or texture of the product.

To a meat material chosen as above, salt is added, and the mixture is ground into a paste. In the presence of salt and the kneading action, salt-soluble proteins in the paste dissolve in liquid, and the paste becomes a viscid mass. Therefore, the paste becomes so resilient that, even if it is molded into fibers, it can withstand the strain imposed during the molding so that it produces long, continuous fibers without being broken midway. The amount of salt added is in the range of 1 to 10% with respect to the weight of the meat material, preferably 2 to 4%. Grinding the mixture can be achieved with an apparatus conventionally used in the manufacture of fish meat paste-based products, such as a silent cutter, vacuum cutter, or mixer equipped with a stirrer.

While the meat mass is salted and kneaded, food additives may be

added as appropriate. Suitable food additives may include, for example, corn starch, wheat flour, starches such as potato starch, seasonings, spices, flavoring agents, pigments, fat, plant proteins or egg-white, etc. These additives may be added as appropriate depending on the desired texture or properties of the product.

As described above, salt is added to a meat material prepared from fish or shellfish, followed by one or more food additives as appropriate, and the mixture is ground into a paste. The paste is milled in a vacuum chamber equipped with a mixer to remove air bubbles. Alternatively, the paste is simultaneously de-aerated and homogenized in a vacuum chamber equipped with a silent cutter. A de-aerated paste is preferred, because then, even if it is subjected to fiber molding in a later step, the resulting fibers will become uniform in their properties without being interrupted midway.

Then, the paste is extruded through nozzles having a small aperture while being pressurized when needed to produce fibers which are then allowed to fall into a hardening solution. The nozzle is made of a metal and has, on its tip, a small aperture with an internal diameter of 1.5 mm or less, preferably 0.1 to 1.0 mm. The aperture may have a circular or ellipsoidal opening. The nozzle may have a single aperture, but usually it has multiple apertures. The nozzle may have multiple complex apertures which are different in shape or internal diameter.

The meat paste is extruded via the nozzles as fibers which are then allowed to fall into an aqueous solution of a mixture of salt and acid, that is, into a protein hardening bath. The concentration of salt in the aqueous solution is preferably 15 percent by weight or more. The acid may include an

inorganic acid such as hydrochloric acid, phosphoric acid, etc., and an organic acid such as acetic acid, citric acid, fumaric acid, lactic acid, malic acid, succinic acid, etc. The amount of acid added is adjusted such that the pH of the aqueous solution falls in the range of pH 3.5-5.5, preferably pH 4.0-5.0. To the aqueous solution of salt and acid, a buffering agent is preferably added, such as sodium hydroxide, sodium acetate, sodium citrate, etc., because then the pH of the aqueous solution becomes stabilized and thus uniform fibers can be obtained. In fact, in order to harden fibers, it is ineffective to use aqueous solutions of salt and acid separately and in series. It is effective to use an aqueous solution containing salt and acid in combination, because, in this case, the salt-based effect and acid-based effect interact with each other producing a multiplied effect, and thus the combined solution hardens fibers rapidly. If the combined solution has a pH out of the above range, fiber hardening will be so insufficient that the fibers will have a texture like that of boiled fish meat paste, or conversely the fibers will harden so strongly that they will not bind to each other in a later process and the resulting meat mass will have a disagreeable texture because of its hardness and brittleness.

Usually, the aqueous solution of salt and acid in combination is used at normal temperature, but it may be heated as needed. Meat fibers extruded from the nozzles are immersed in the aqueous solution typically for several seconds to three minutes where proteins on the surface of the fibers are hardened, to produce unbound hardened fibers, or hardened fibers each of which retains a certain amount of binding activity. If more hardened fibers are required, the duration the fibers are immersed in the solution may be lengthened. The denaturation/hardening or mechanical strength of the fibers

can be varied as appropriate by adjusting the size of the nozzle aperture and extrusion pressure, and, with regard to the hardening solution, the kind of acid, its concentration, pH, immersion time, etc. can be varied. This may improve the efficiency of the later process of gathering and binding the fibers.

The single or multiple unbound fibers which have undergone molding and hardening in the aqueous solution of salt and acid in combination are then rinsed with water as needed. They are gathered and heated so that they become partially bound to each other while maintaining their respective fiber forms. Partial binding of the fibers may occur in any form: out of plural groups of fibers, fibers may be extracted one from each group to be bound together; every pair of adjacent fibers may be bound at one or more sites; and the two forms of partial binding may be combined as appropriate. Partial binding of the fibers may be achieved by any method. For example, single or plural, straight fiber(s) may be wound into curls, or entangled to take any desired form, and the resulting fiber(s) may be placed in a container such as a basket, strainer, net, or retainer; a desired number of fibers may be placed one after another in parallel with each other in a steam cooker; fibers may be allowed to continuously accumulate on a conveyor; or fibers may be passed through the gap between rollers. The fibers are subjected, as patches or continuous fibers, to heating treatment based on exposure to hot water or hot steam, or to radio waves as desired.

Heating causes not only the proteins of the fibers to harden but also the fibers themselves to bind to adjacent fibers owing to their retained binding activity at discrete sites, for example, at sites where they come close, overlap, or intersect, without requiring the use of a binding agent, while maintaining

their respective fiber forms. The partial binding of fibers, or the ratio of a bound fiber component to an unbound fiber component can be varied as appropriate by adjusting the pressure applied to the gathered fibers during heating. When strong pressure is applied widely, a flake-like meat mass is obtained in which the fraction of the bound fiber component is large as compared with that of the unbound component. The degree of partial binding of the fibers can be adjusted by varying the applied pressure, which may be achieved, for example, by placing, as appropriate, a weight or weights on the partial or entire surface of the gathered fibers before and after heating, passing the gathered fibers between opposite rollers, applying a pressurized roller on the gathered fibers, or placing layers of fibers one over another thereby pressing the fibers by means of their own weight. In fact, partial binding may occur not only in one direction but also in multiple directions.

The fiber mass obtained as above in which the fibers are partially bound to each other is cut with a cutter, chopper or slicer into pieces having a desired length. During cutting, an external force is applied to the fiber mass, which may promote the binding of fibers, or conversely dissociate the bound fibers, thereby further emphasizing the flake-like texture of the resulting meat mass. The cut pieces preferably have a length of 0.5-3 cm. Cutting is preferably performed soon after heating, because then the binding of the fibers is further strengthened.

Then, the cut pieces are rinsed with water. Water rinsing removes excess salt and acid, and may cool the pieces. Moreover, if further seasoning, flavoring or coloring is needed, the pieces may be boiled in a seasoning solution, or immersed in a solution containing a mixture of flavoring and

seasoning agents, or in a staining solution. The staining may be achieved while the fibers are gathered and heated. For example, it is convenient to stain the fibers by applying a staining solution to them before or after heating, or staining them during boiling.

The fibrous flake-like food thus obtained does not have an unpleasant odor characteristic of plant proteins or an acid or alkali taste, in contrast with conventional fibrous products made of plant proteins or meat fiber-based products obtained by alkali doping. It is free from an odor characteristic of fish meat in contrast with commercial crab-leg rods, has no sweet taste, has a good taste, flavor and color, and, distinct from boiled fish meat paste in texture and properties, has a fibrous texture and resistance to bite as do resilient and elastic muscle fibers. The texture of the food comprises partly unbound fibers and partly bound fibers conglomerated into bundles, and looks quite similar to the flaked meat obtained by loosening the muscles of crab meat or scallop's adductor muscle. The food has such a characteristic texture that it has no equivalent among any processed meat products.

The inventive method has the following advantages as compared with the conventional method. First, prior to fiber molding, salt is added to a meat material prepared from fish or shellfish, which is followed by the addition of an additive or additives. The mixture is kneaded and the resulting paste is extruded through nozzles into fibers which are allowed to fall into an aqueous solution of salt and acid in combination to complete fiber molding. The process is simple and efficient. Minced meat of fish or shellfish may be used neat as a material without requiring further refining such as purification or concentration. The paste may contain extra ingredients, and thus further

improvement of the product quality by any means is possible. The stability of the product may be improved. The fibers obtained by the inventive method are so resilient that they can be thin and continuous without being interrupted midway during molding. Furthermore, according to the inventive method, after molding, the fibers still retaining binding activity are hardened, and then subjected to heating to be gathered and partially bound. Thus, the partial binding of fibers can occur in a simple continuous process without requiring the use of a binding agent, and the resulting product comprises a mixture of unbound fibers and bound fiber masses, giving a so-called flake-texture closely resembling that of flaked meat. The inventive method is simpler and freer from complication than the method whereby unbound fibers and bound fiber masses are separately prepared and then combined. The product obtained by the inventive method is free from an unpleasant taste, odor or texture which might arise if a binding agent were used, and never fails to exhibit a texture closely resembling flaked animal meat. The strength, ductility, texture and binding of the fibers can be varied as appropriate according to given conditions by adjusting, with regard to the hardening aqueous solution, the kinds of salt and acid, their concentrations, pH, temperature of the solution, its flow speed, etc., the size of nozzle aperture and extrusion pressure, manner of fiber gathering, heating method, and pressure applied to the fiber mass and method of cutting, etc. The inventive method can provide products widely varied in texture and shape, and is suitable for widely varied applications.

According to the inventive method, it is possible to obtain fibrous flake-like food products excellent in quality simply and efficiently by using fish or

shellfish meat as a material, processing the material into thin fibers, and gathering and partially binding the fibers to each other. The inventive method is truly effective in providing such fibrous flake-like meat products.

Examples produced by the inventive method will be described below.

Example 1

To 10 kg of sliced frozen pollock meat, 400 g of salt and 2 kg of potato starch powder were added, and the mixture was de-aerated and homogenized with a silent cutter to produce a paste. The paste was extruded, under pressure applied via a hydraulic apparatus, through 30 circular nozzles having an internal diameter of 0.7 mm and two ellipsoidal nozzles having a cross-section of 0.7x1.5 mm into fibers which were transferred to an aqueous solution (pH4.7) containing salt at 15%, acetic acid at 1.5%, and sodium hydroxide at 0.6%. The fibers were immersed in the solution for two minutes, and allowed to accumulate on a net conveyor to form a layered structure having a thickness of 20 mm. The layered structure was exposed to hot steam for ten minutes in a steam box. Then, a red pigment was applied as patches on the surface of the fiber mass. Immediately thereafter, the fiber mass was cut with a chopper having a concave blade with an internal diameter of 18 mm into fiber pieces. The fiber pieces were rinsed with water for 15 minutes. The fiber pieces were transferred to a mixer, 250 g of a seasoning and 40 g of a flavoring agent were added, and the mixture was stirred to produce 12 kg of a fibrous product having a texture like flaked crab meat.

The product having a texture like flaked crab meat was used as a test sample. This was compared with a comparative sample prepared from a

commercially available boiled, minced fish meat paste having a crab meat texture. The test was performed by 30 testers on a yes-or-no preference basis (each tester never failed to choose either of the two samples according to his/her preference, and the results were summed for each sample, and the two results were compared). The results are shown in Table 1. The test sample was chosen by the testers significantly more positively at a 1% error.

Table 1

	Shape	Color	Texture	Flavor/taste
Testers in favor of test sample	25	26	28	24
Testers in favor of comparative sample	5	4	2	6

Example 2

To 3 kg of squid legs which had been skinned by being immersed in an alkali solution and 2 kg of fillets of pollock, 200 g of salt, 500 g of corn starch, 150 g of wheat gluten, and 700 g of soybean oil were added, and the mixture was ground with a silent cutter. The mixture was then de-aerated and homogenized with a mixer to give 8.5 kg of a paste.

Under pressure applied via a gear pump, the paste was extruded through nozzles having a diameter of 0.3 mm into fibers which were then allowed to fall into a citric acid-buffered, salt-saturated solution with a pH adjusted to pH 4.6. The fibers were immersed in the solution for one minute to be hardened. The fiber mass was transferred to a metal mesh strainer, and immersed in boiling water for seven minutes while being pressed by a weight of 2 kg placed thereupon. Immediately after the fiber mass was

removed from the water, it was cut with a silent cutter into pieces having a length of about 12 mm, and the pieces were rinsed with water to provide 8.3 kg of a fibrous product having a texture like that of flaked scallop's eyes.

The fibrous product having a texture like that of flaked scallop's eyes was transferred together with a seasoning solution into cans which were then de-aerated and capped, and sterilized by being kept at 114°C for 60 minutes. A test sample was extracted from the canned product. A comparative sample was tested from marketed canned food consisting of flaked scallop's eyes. The test sample was compared with the comparative sample by means of a yes-or-no preference test. The results are shown in Table 2. There was no significant difference between the two samples.

Table 2

	Testers in favor of
Test sample	11
Comparative sample	13

Example 3

To 1 kg of skinned fresh meat of Antarctic krill, 30 g of salt, 100 g of starch, 30 g of egg-white, 30 g of soybean protein, 30 g of wheat protein, and 0.1 g of a coloring agent were added. The mixture was ground with a mixer equipped with a stirrer. The mixture was then de-aerated and homogenized with a vacuum-mixer to give a paste. The paste was extruded through nozzles having an internal diameter of 0.3 mm into fibers which were allowed to fall into a 20% aqueous solution of salt with a pH adjusted to pH 3.0 with hydrochloric acid. After being immersed in the solution for one minute, the

fibers were wrapped with film made of vinylidene chloride. The pack was placed in a steamer to be steamed for 10 minutes. The pack was then rinsed with water for three minutes, and cut into pieces having a length of about 8 mm. The pieces were boiled in a seasoning solution for three minutes, and 1.1 kg of a fibrous product having a texture like that of flaked shrimp meat was obtained.

A sample weighing 500 g was extracted from the fibrous product having a texture like that of flaked shrimp meat, to which was added 150 g of a meat paste of pollock to serve as a binding agent. The resulting mixture was molded into cylindrical rods having a size of 15 mm (width) x 8 cm (length). The rods were coated with breadcrumbs and frozen-stored at -30°C. The rods were then thawed and fried for three minutes by immersing them in oil kept at 173°C. The fried rods had a flavor, taste and texture closely resembling those of commercially available fried shrimp meat.

Agent of the applicant, Kiyoshi Inomata